A critical appraisal of "Use of an Anti-Gravity Treadmill for Early Postoperative Rehabilitation After Total Knee Replacement: A Pilot Study to Determine Safety and Feasibility"

By

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Abstract

The critical appraisal seeks to find clinical significance and validity of the study to determine if an anti-gravity treadmill is a beneficial treatment for gait training of patients with total knee replacements. Each section of the article was analyzed to determine strengths and weaknesses, which would suggest whether the findings of this article could be applied. Overall, this article contains many strengths that support the validity of the study. It was found that the article is valid and provides clinical implications for the use of anti-gravity treadmill in the treatment of patients.

Key words: anti-gravity treadmill, total knee replacement, rehabilitation

Introduction

Following a total knee replacement, all patients must undergo physical therapy treatment to regain a normal gait pattern. Many physical therapy settings will do a traditional land based therapy to gait train a patient using a variety of techniques, but it has been hypothesized that reducing gravity and weight effects may be beneficial for the patient and lead to greater improvements during and following treatment. This hypothesis could lead to the treatment of patients following a total knee replacement surgery in different ways than has been traditionally done. Since this study was completed, it can be used to determine if patients with a total knee replacement would benefit from use of anti-gravity treadmill treatment to restore normal gait patterns.

Methods

For the literature search process, a variety of databases were used such as PEDro, PUBMED, Cochrane Library, and CINAHL with searches for the key words: anti-gravity, knee arthroplasty, aquatic, anti-gravity treadmill, and total knee replacement. Limits were not placed on the database searches because there were a low number of results returned as compared to anticipation of many articles in this area being relatively easy to find. To be an article that was included for review, the study had to consider the effects of either aquatic therapy or anti-gravity treadmill therapy on patients following a total knee replacement surgery. At the end of the literature search, there were twelve articles that were further screened to determine which would be most relevant to the research question.

The chosen article was published in 2016 by Dr. Bugbee, an Attending Orthopedic Surgeon, Ms. Pulido, a project manager in musculoskeletal research, Dr. D'Lima, a Director of

Orthopedic laboratories and Mr. Goldberg, a physical therapist. The article was published in The American Journal of Orthopedics and the study was completed in California. It was chosen for critical appraisal because it addressed the use of anti-gravity treadmills in the treatment of gait patterns of patients following total knee replacement as compared to a control group receiving land based therapy. The article was meant to analyze if these treadmills were safe and if they provided benefits compared to land therapy gait training.

Results

Summary of the study

This study was done to find the safety of using an anti-gravity treadmill for patients with total knee replacement and was intended to look at the potential benefits of this treatment. Before the study, it was known that there was a concern with using high intensity intervention immediately following surgery, because of this there is a great possibility that anti-gravity treatment would be advantageous for patients with total knee replacements. Thirty patients were selected for the study and randomized to a control group or treatment group. The control group would receive land-based therapy for gait training and the treatment group used the anti-gravity treadmill. All thirty patients had to meet inclusion and exclusion criteria to be accepted into the study. Data was collected using the Knee Injury and Osteoarthritis Outcome Score (KOOS), Timed Up and Go test (TUG), and Numerical Rating Scale (NRS) at baseline, end of physical therapy treatment and end of the study. Twenty-nine of the patients completed the study and it was found that treatment with an anti-gravity treadmill was safe and effective and physical therapists were highly satisfied with the way the treadmill worked.

Appraisal of the study introduction

This article has a well written and very clear introduction that provides enough background information to explain the hypothesis of the study. The authors did not leave out any necessary information and there is no further information needed to provide a clear basis for the article. They based the hypothesis off of sound rationale and explained the purpose. The references used to provide background information are all relatively recent with the oldest article having been published in 2001. It should also be noted that the majority of the articles come from primary sources and were good choices to form the background of this study. The information provided in the introduction allows the reader to easily identify the independent and dependent variables of the study.

There are a couple of weak points found in the introduction to the article. One of the literature references does not site a journal but instead just a website. This article may have useful information but not the best choice since this is not easily recognizable as credible without looking much deeper into the information. Another piece that the authors could have provided would have been a list of key words for the article. A key words list can make it clear as to the information that is expected to be found in the introduction and researched.

Appraisal of the study methods

The research design is a prospective, cross sectional, randomized clinical trial. The study evaluated two groups for a between-subjects design and it was determined that the two groups had similar demographics. The same therapy protocol and outcome measures were used for each subject. The article also made it clear that data was collected using these outcome measures at baseline, the end of physical therapy/final session, and at the end of the study which was three-month post-operative. The study also clearly stated the statistical analysis tests that were used to analyze the data.

Weak points found in the article were that not all 30 patients completed the study, which could lead to skewing of the data although unlikely and it is also a positive that the reason for the one patient loss was provided. It was also left unclear if the group assignment was concealed from the people enrolling individuals in the study, which could also lead to bias where patients were assigned to groups based on how well they were doing at the time. Outcome assessors were not blinded either due to the fact that they were also treating the patients and knew which treatment their patients were receiving. It would have been possible to have masked the outcome assessor by having an outside clinician come to perform the outcome measures and record that data. It is possible that bias and data skewing could occur because of the outcome assessor knowing which treatment a patient was receiving. The biggest issue was that although the treatment session is described fairly well with an outline, there were parts of the treatment session left up to the judgement of the physical therapist based on the level that the individual patient was at. Since there were variables left up to the treating physical therapist, it would be challenging to replicate the study exactly and would require an experienced physical therapist using their clinical judgement. More information could be given about each of the selected outcome measures such a reliability and validity for the tests, but it is positive that articles were cited for each outcome measure used.

Appraisal of the study results

Results of each outcome measure were presented in the same order as they were stated in the methods section of the article in a clear and organized manner. The data was able to answer each research questions and addressed the hypothesis of the study. All figures and tables used to show the data were easy to read and interpret. The threshold of p-value is 0.05 and the CI used was 80%. These values were used to analyze the data and determine the statistical significance.

Functional outcomes that were determined to be statistically significant included improvement from baseline to end of physical therapy and baseline to end of study for KOOS, TUG, and NRS. Most importantly clinically meaningful information was that use of an anti-gravity treadmill is safe and effective for gait training and that data shows that use of an anti-gravity treadmill and land based therapy shows equal improvement.

Problems with the results are that one of the outcome measures that was supposed to be collected was not recorded in the table of the results section. The measure left out was the end of physical therapy scores for KOOS. Other information that could be useful would be a minimal clinically important difference and number needed to treat which were not stated in this article.

Appraisal of the study discussion

The discussion goes deeper than a repetition of the results section and shows that it is safe to use an anti-gravity treadmill for treatment, but more studies are needed to indicate if the treatment is more effective than land based gait training. All conclusions of the study were reflective of the findings of the study and the authors did not over conclude. It was stated that the treadmill was safe and feasible for total knee replacement rehabilitation and was well tolerated by patients. It was also stated that physical therapists were satisfied with the equipment used for anti-gravity treatment. All of these conclusions are reflective of the data collected from the study. Conclusions about whether the treatment was more beneficial was not concluded, but instead it was stated that further research would be necessary based on the data collected during this study. From the findings in the study, the authors also compared results to existing literature and all literature used was from current and credible journals. The authors recognized and mentioned limitations of the study and it was noted that differences in functional outcomes compared to traditional rehabilitation could not be detected because of the small number of patients, and a larger study group would be necessary to determine if the anti-gravity treatment is more beneficial.

The other limitation recognized was that the standard scoring systems such as KOOS, TUG, and NRS may not be sensitive enough to detect differences in a small sample size of patients. Suggestions for future studies included hypothesis that earlier institution of the anti-gravity device during immediate postoperative period would be more beneficial compared to standard postoperative PT. It is suggested to have a larger sample size and additional outcome measures would be needed to analyze differences between treatments. Another suggestion is to perform a cost-benefit analysis because of increasing health-care expenses. It is recognized by the authors that treatment needs to be both beneficial and cost effective.

No weaknesses were found in the discussion portion of this piece of literature. The authors were very thorough in making sure that they covered all information, limitations of the study were recognized and indicated the need for further studies.

Discussion

The use of an anti-gravity treadmill for treatment is clinically significant because it could change the way that therapy is done following surgery, especially knee replacements. This could also mean that other surgeries should have therapy that includes anti-gravity treatments in the future. It is clear that anti-gravity treadmills are a safe and effective alternative for gait training with equal benefit to land based therapy. It is also indicated that this type of therapy would be a good alternative for patients that have a decreased weight-bearing status. This information indicates that normal gait patterns can be restored with therapy that includes training on an anti-gravity treadmill and answers the question that was sought after at the beginning of the literature search.

The anti-gravity treadmill is a safe and effective treatment that can be used for patients that have total knee replacement. It is indicated that this type of treatment is just as beneficial as land based therapy and has no adverse side effects. This means that potential risk is very minimal for this type of treatment and potential benefits includes a way to train that can decrease weight bearing and improve gait abnormalities. Since there are very few risks related to treatment in this way the benefit of having decreased weight bearing with equal benefit to traditional therapy shows that this is a sound treatment option. To further indicate potential benefits further study should be done with an increased number of patients, to see if this treatment is more beneficial than land based therapy instead of just equal to it. The study should also include blinding of the person in charge of randomizing patients to their groups and blinding of the outcome assessor. In this case it may not be possible to blind the patients to their group.

This research seems to hold valid evidence for the application of anti-gravity treadmills during a treatment session. It should be considered for patients as a valuable treatment option that is safe for the them to use. This type of treatment would be appropriate if the equipment was available.

The anti-gravity treadmill treatment for gait training is a good option for patients following a total knee replacement. The treatment with this type of equipment is safe and effective and could have many applications following more study especially for patients with a decreased weight-bearing status.